Short Communication

Effect of Spinal Anesthesia and General Anesthesia on Neonate's Apgar Score in Cesarean Section: A Comparative Study

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Abstract

Background: Cesarean section (CS) is a common surgical procedure for delivering babies, with approximately one in three births in the United States involving this method. CSs can be performed under general anesthesia (GA), rendering the patient unconscious, or regional anesthesia, numbing the lower part of the body. **Objectives:** This study aimed to compare the impact of spinal and GA on the Apgar scores of neonates born through elective CS. The Apgar score assesses a newborn's heart rate, respiratory effort, muscle tone, reflex irritability, and color, with a score of 7 or higher considered normal. **Materials and Methods:** Conducted at Babylon Maternity and Children Teaching Hospital in Iraq, the study included 60 women scheduled for elective CS. About 30 women received spinal anesthesia (SA), whereas 30 women received GA. Apgar scores were recorded at 1 and 5 min after birth. **Results:** The study demonstrated a notable difference in the Apgar scores of neonates delivered via elective CS, depending on the type of anesthesia administered to the mother. At 1 min postbirth, 83.3% of neonates whose mothers received GA had Apgar scores of 6 or below. In contrast, only 10% of neonates whose mothers received SA exhibited similar scores. However, by the 5-min mark, the differences in Apgar scores between the two groups were not statistically significant SA. **Conclusion:** The findings indicate that neonates born through elective CSs tend to have higher Apgar scores at 1 min after birth when SA is used compared with GA. Nonetheless, no significant differences in Apgar scores were observed at the 5-min mark.

Keywords: Apgar, cesarean surgery, comparative study, general anesthesia, neonatal intensive care unit, spinal anesthesia

Introduction

Cesarean section (CS) stands as one of the most prevalent surgical procedures performed worldwide.[1] When it comes to providing anesthesia for CS, two primary options emerge general anesthesia (GA) and spinal anesthesia (SA). The selection between these techniques hinges on a multitude of factors, including the condition of both the mother and the fetus, the patient's obstetric history, and the preferences of the patient and the anesthesiologist.[2] Ultimately, the overarching objective of anesthesia during CS is to establish a secure and comfortable environment for the mother while minimizing risks to the fetus.[3]

Research studies have suggested that the case fatality rate for cesarean delivery is comparatively higher when utilizing GA, in contrast to regional anesthesia. GA offers distinct advantages, such as its rapid induction, limited cardiovascular depression due to sympathetic inhibition, and the ability to secure and control the patient's airway and respiration.[4] The swiftness and reliability of GA can sometimes overshadow a detailed consideration of its disadvantages.[5] Within the realm of anesthesiology, SA has often been the preferred choice for uncomplicated elective cesarean deliveries due to

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its ease of administration and the ability to circumvent potential risks, such as difficult intubation and aspiration in parturient patients.[6] Immediately following birth, the Apgar score emerges as a crucial measure comprising five parameters: heart rate, respiratory effort, muscle tone, reflex irritability, and color. Each of these parameters is assessed on a scale ranging from 0 to 2, thereby generating a total score within the 0–10 range. A low Apgar score at 1 and 5 min after birth is associated with an elevated risk of neonatal morbidity and mortality. Numerous studies have sought to compare neonatal outcomes between SA and GA in CS procedures. A retrospective cohort study by Aboud *et al.*[7] reported that infants born via SA exhibited a higher mean Apgar score at 5 min than those born under GA (9.5 vs. 9.3, $P = 0.02$). However, this study found no significant disparity in neonatal intensive care unit (NICU) admissions or incidents of respiratory depression between the two groups.

In a systematic review and meta-analysis conducted by Sultan *et al.*,[8] encompassing 49 randomized controlled trials, it was revealed that infants born via SA demonstrated significantly higher mean Apgar scores at both 1 and 5 min compared with those born under GA. Moreover, the incidence of neonatal respiratory depression was notably lower in the SA group. Nevertheless, the study also highlighted that infants born via SA exhibited a higher prevalence of hypotension, bradycardia, and neonatal acidosis when contrasted with infants born via GA. Another retrospective cohort study by Kundra *et al.*[9] uncovered no marked differences in Apgar scores or NICU admissions between infants born through SA and GA. Notably, infants born through SA displayed a considerably lower incidence of neonatal respiratory depression and a shorter hospital stay duration compared with their GA counterparts. In light of the existing literature, it appears that SA may indeed offer superior neonatal outcomes when juxtaposed with GA in the context of CS. Consequently, the selection of anesthesia for CS should be individualized, taking into account the specific maternal and fetal conditions, alongside the experience and preferences of the anesthesiologist.[10] It is worth noting that while some studies have advocated for the superiority of SA in neonatal outcomes, others have found no substantial discrepancies between the two techniques.[11] The present study aims to discern the impact of SA versus GA on the Apgar scores of neonates born via full-term elective CS.

Materials and Methods

Study design

This research is a cross-sectional, comparative study conducted at Babylon Maternity and Children Teaching Hospital, specifically at the Obstetrics and Pediatrics Hospital. The study was carried out from February 2023 to July 2023.

Study population

The study population comprised 60 healthy mothers with full-term pregnancies, who were scheduled for elective lower-segment CSs. Of these participants, 30 received GA, whereas the remaining 30 received SA. Apgar scores were assessed at two critical time points—1 and 5 min after delivery for all participants.

Anesthesia technique

The administration of GA began with obtaining a comprehensive medical history from the patients, encompassing details such as age, parity, duration of pregnancy, maternal health history, and obstetric history. This was followed by blood pressure measurement, airway assessment, and the insertion of an 18-gauge intravenous catheter. Intravenous fluids and blood were administered, and the patient was positioned in a supine orientation with left uterine displacement. Continuous monitoring of pulse, blood pressure, and oxygen saturation was maintained, with preoxygenation preceding induction through the injection of thiopentone and succinylcholine. Endotracheal intubation was performed, and GA was sustained with atracurium. For SA, a parallel procedure was followed, with specific inquiries regarding any prior back surgery. Hyperbaric bupivacaine was administered following a lumbar puncture between the third and fourth lumbar spine. Patients were again positioned supine with left uterine displacement, and monitoring of pulse, blood pressure, and oxygen saturation was conducted. Apgar scores were documented for all 60 neonates at both 1 and 5 min postdelivery, alongside the recording of each baby's birth weight. These Apgar scores were subsequently compared with the standard Apgar score chart.

Inclusion criteria

The inclusion criteria are as follows:

- Pregnancies at full term and between 30 and 38 weeks of gestation.
- Pregnant women registered for CS.

Exclusion criteria

The exclusion criteria are as follows:

- Pregnancies associated with liver, heart, or kidney failure.
- Uncontrolled metabolic disorders such as diabetes mellitus, hypertension, and thyrotoxicosis.
- Multiple-fetus pregnancies.

Data collection and statistical analysis

Data collected during this study were subjected to statistical analysis using SPSS version 25.0. Descriptive and analytic

Table 1: Overview of the characteristics of the study participants

Variable	Group	Mean ± SD	Range	*P* value
Mother's age (years)	All cases	28.9 ± 5.23	18–37	
	GA group	29.00 ± 5.18	19–37	0.55
	Spinal group	28.13 ± 5.2	18–37	
Neonates' birth weight (kg)	All cases	3.07 ± 0.22	2.8–3.5	
	GA group	3.10 ± 0.11	2.8–3.5	0.53
	Spinal group	31.2 ± 0.12	2.8–3.5	

GA: general anesthesia, SD: standard deviation; $P \geq 0.05$

Table 2: Apgar score at 1 min and type of anesthesia

Apgar score at 1 min	GA	Spinal	Odd ratio	*P* value	Total
≤6	24 (83.2%)	11 (33.4%)	11	0.00024	35 (58.3%)
≥7	6 (17.7%)	19 (65.7%)			25 (41.7%)
Total	30 (100%)	30 (100%)			60 (100%)

statistics were employed, with the mean and standard deviation (SD) used to express age and weight data. The Student *t* test was utilized to compare these continuous variables across the two groups. Data presentation was done through tables, graphs, and descriptive text. A significance level of ≤0.05 was considered for all statistical procedures and tests.

Ethical approval

Ethical approval for this study was granted by the scientific research committee at the faculty and the governmental health department (Approval Number: 3/11/2856, dated January 11, 2023). Informed written consent was obtained from all participants, ensuring compliance with ethical guidelines.

Results

The mean mother age and neonates' birth weight are very similar for the all cases group and the GA group. The mean mother age is slightly higher for the GA group, but the difference is not statistically significant (P = 0.55). The mean neonates' birth weight is also slightly higher for the GA group, but again, the difference is not statistically significant (P = 0.53). The mean neonates' birth weight for the spinal group is slightly lower than for the other two groups, but the difference is not statistically significant. This means that there is not enough evidence to conclude that the type of anesthesia affects neonates' birth weight, as shown in Table 1.

Table 2 shows the number and percentage of newborns in each anesthesia group who had an Apgar score of ≤6 or ≥7 at 1 min. It also shows the total number and percentage of newborns in each group. A higher percentage of newborns in the GA group had an Apgar score of ≤6 at 1 min (83.2%) compared with the spinal group (33.4%).

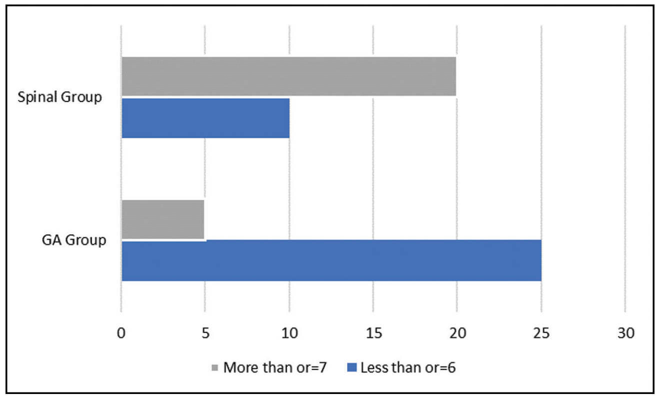

Figure 1: Apgar score and anesthesia type distribution

This means that newborns in the GA group were more likely to need resuscitation at birth. The odds ratio of having an Apgar score of ≤6 at 1 min is 11 times higher for newborns in the GA group compared with newborns in the spinal group (odds ratio = 11, P = 0.00024). This statistically significant difference indicates that the type of anesthesia is a risk factor for having a low Apgar score at 1 min.

Figure 1 illustrates the distribution of Apgar scores based on the type of anesthesia administered. Newborns in the GA group were more likely to have low Apgar scores at 1 and 5 min after birth compared with those in the spinal group. This suggests that newborns in the GA group had a higher likelihood of requiring resuscitation at birth. The odds ratio for having a low Apgar score at 1 min was 11 times higher for newborns in the GA group compared with those in the spinal group. This statistically significant difference indicates that the type of anesthesia is a risk factor for a low Apgar score at 1-min.

Discussion

The Apgar score, introduced by Virginia Apgar in 1953, is a crucial tool for the immediate assessment of newborns, helping identify those in need of resuscitation and providing insights into their chances of survival during the neonatal period.[12]. A low Apgar score at 1 min postbirth often indicates the need for urgent resuscitative measures, whereas scores at 5, 10, 15, and 20 min are important for predicting the likelihood of successful infant resuscitation.[13] The type of anesthesia used during cesarean deliveries significantly influences neonatal Apgar scores. GA and SA are the primary methods, with regional anesthesia, including spinal and epidural approaches, generally preferred due to lower maternal mortality and fetal depression rates compared with GA.[14] The risks associated with GA typically involve airway management complications, such as intubation or ventilation difficulties, whereas regional anesthesia risks primarily involve excessive neural blockade or local anesthetic toxicity.[14] The literature presents varying perspectives on the impact of different anesthetic techniques on Apgar scores. For instance, one study[15] found no significant difference in the Apgar scores of neonates at the 5-min mark between those delivered via GA and SA during elective CSs of healthy patients. In contrast, another study[16] reported significantly lower Apgar scores at 1 min in neonates born under GA compared with those born under SA. Similarly, a study[17] comparing GA and SA found no significant difference in the mean 1-min Apgar scores but noted that more neonates in the GA group appeared depressed immediately after birth, requiring supplemental oxygen and bag-mask ventilation. Additionally, some researchers recommend performing cesarean deliveries under GA within 6–8 min after induction to prevent neonatal depression due to nitrous oxide diffusion through the placenta.[18] Overall, SA is generally considered safer for both mother and newborn, as it reduces neonatal exposure to depressant medications, lowers the risk of maternal pulmonary aspiration, allows the mother to be alert during birth, and provides an option for postoperative pain management through spinal opioids.[19] Therefore, it is advisable to use SA for cesarean deliveries in healthy patients to minimize the use of intravenous agents that may contribute to fetal depression, particularly at the critical 1-min postdelivery point. The choice of anesthesia technique in cesarean deliveries plays a significant role in neonatal outcomes as assessed by Apgar scores. The existing literature highlights the complexity of this decision, with varied findings. Clinicians must carefully consider the risks and benefits of different anesthetic methods, taking into account the unique characteristics of each patient and the potential impacts on neonatal well-being. Further research and standardization are needed to provide clearer guidelines for anesthetic decision-making during CSs.

Conclusion

The choice of anesthesia during CS deliveries can influence neonatal Apgar scores, with research outcomes showing variability. Some studies indicate no significant difference between GA and SA, whereas others report lower scores associated with GA. SA is generally favored for its perceived safety advantages for both the mother and baby, characterized by lower rates of maternal mortality and fetal depression, alongside the benefit of postoperative pain relief. Therefore, it is recommended to prioritize SA for healthy CS patients to mitigate the potential risks associated with intravenous agents that could lead to neonatal depression. Despite this recommendation, individual patient factors should be carefully considered, and ongoing research efforts are crucial in refining our understanding of the optimal anesthesia approach for CSs.

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Conflicts of interest

There are no conflicts of interest.

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